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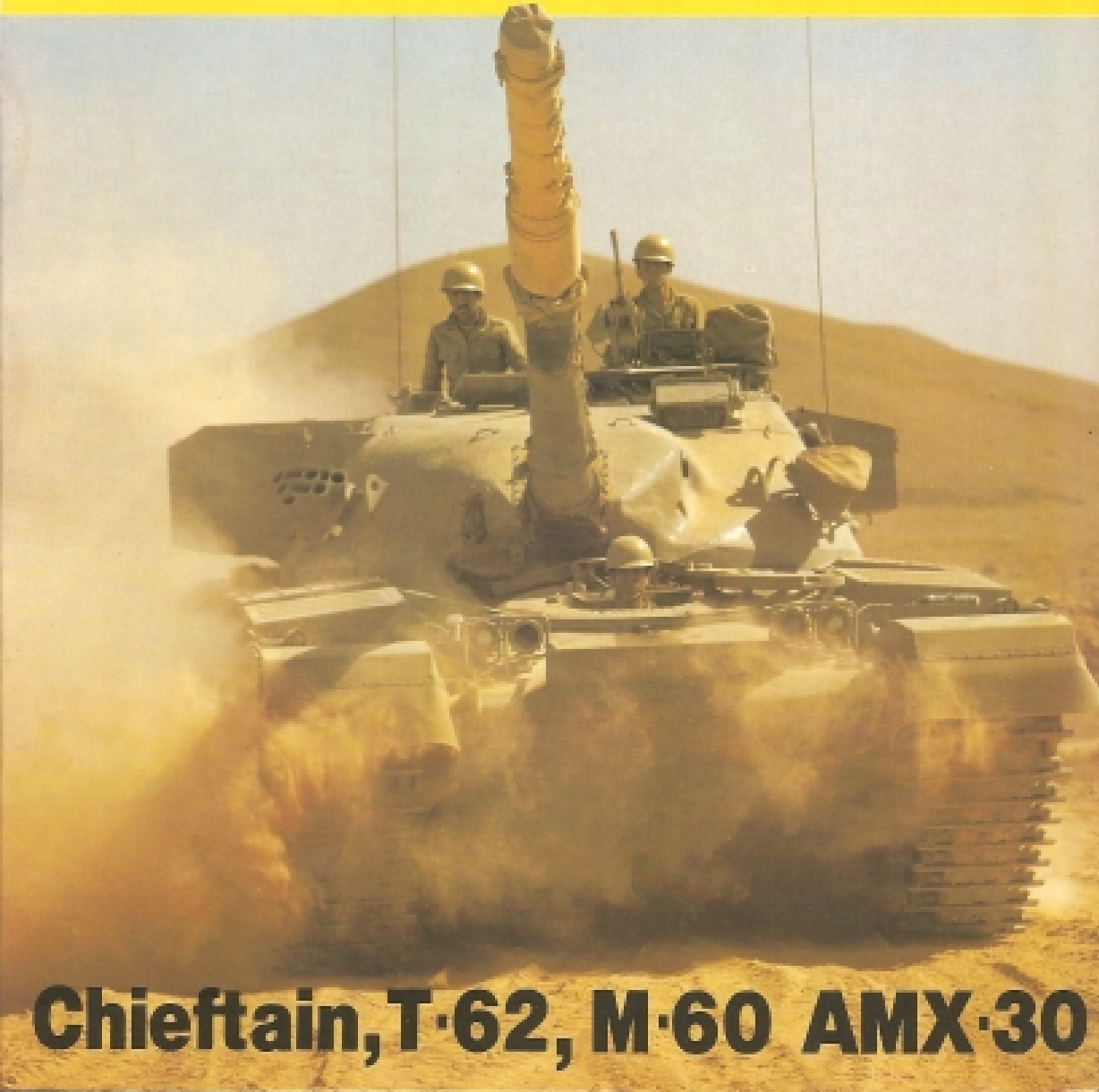
MAIN BATTLE TANKS Part I



Chieftain, T·62, M·60 AMX·30

MAIN BATTLE TANKS

(part I)

INTRODUCTION

This issue is the first of two dedicated to the description of modern main battle tanks. In this issue we present three armoured fighting vehicles which have already made history in armoured warfare.

The T-62 has seen combat with the Syrian and Egyptian armies in the Yom Kippur War, while the M60 has fought on the Israeli side in the savage tank battles in Sinai and on the Egyptian west bank in the later stages of this war. Chieftains are fighting on the Iranian side against Iraqi T-62s and possibly AMX-30s in the Iraqi-Iranian War. Further Chieftains are about to enter service with the Jordanian Army, which already contains several types of the M-60. Finally, the Saudi Arabian armed forces already have several hundred AMX-30s, the largest number of these vehicles outside the French Army. Although the AMX-30 has yet to see combat action, it is nevertheless an exceptional tank whose merits are evident.

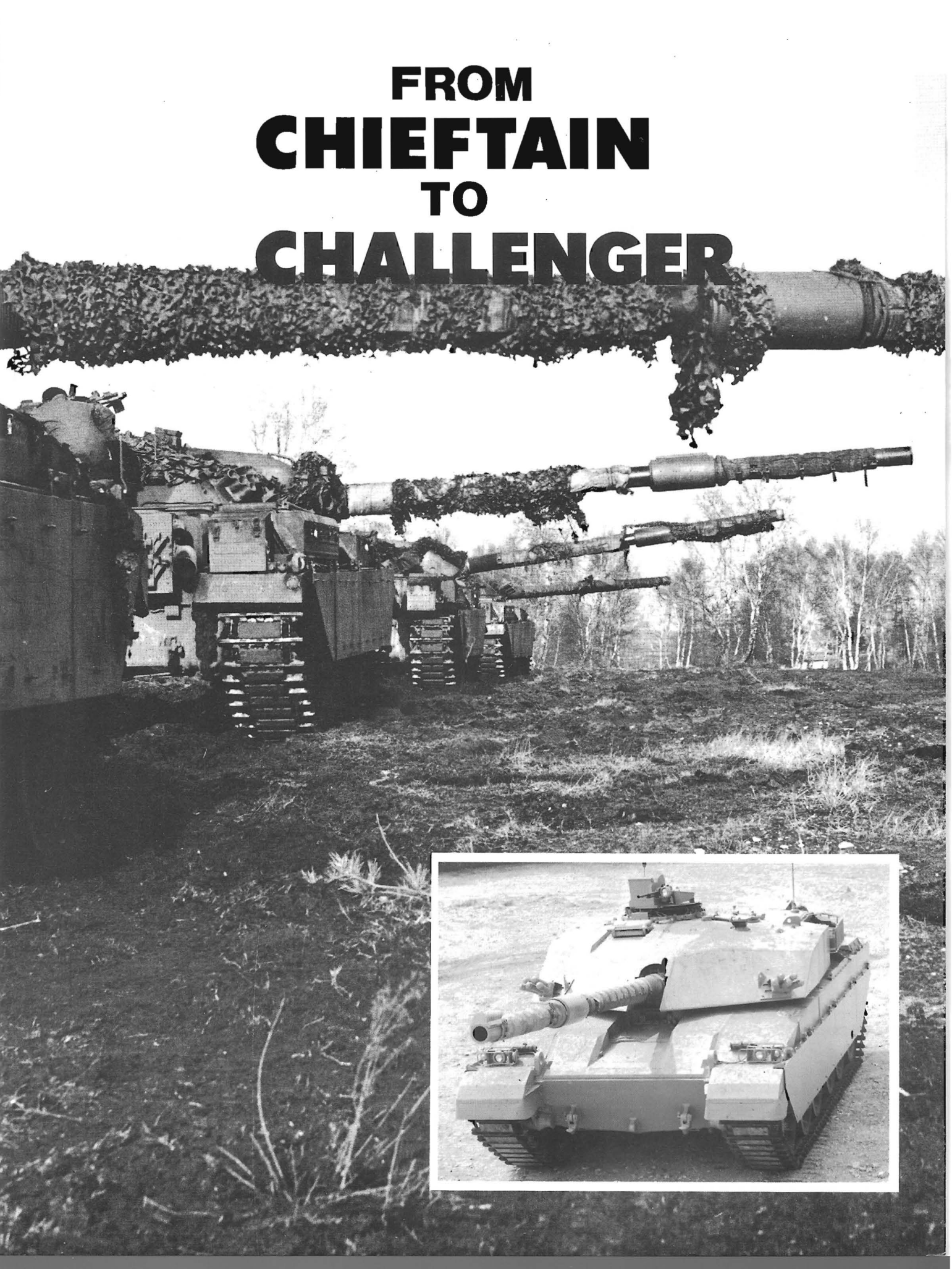
A version of its powerful 105mm gun has indeed seen active service mounted on Israeli M51 Supershermans, which proved itself against contemporary Soviet tanks in the Six Day and Yom Kippur Wars.

The story of tank development is a fascinating one. In a constant battle for its survival, the tank had to overcome trends in development of tank-killing weapons which came about as soon as the tank made its appearance on the battlefields of France in the First World War. However effective the anti-tank weapons became, the tank survived, its main armament irreplaceable for quick reactions, deadly accuracy and killing effect. Its morale-boosting effect on the fire-saturated battlefield is still very high, in spite of the temporary setbacks caused by the appearance of superior anti-tank weapons.

The survivability of the tank may increase with the development of advanced armour protection technologies, the first of which are currently entering service. Moreover, the combat effectivness of the tank may even increase with the development of powerful kinetic energy ammunition now that the shaped charge round, which ruled the anti-tank battlefield for close to 30 years, may have reached its zenith.

In our next issue we shall present the current generation of Main Battle Tanks, the XM-1, Leopard II and T-72.

FROM CHIEFTAIN TO CHALLENGER



Chieftains Mk5 of A Squadron, 4 RTR in front of the Olympic Stadium, Berlin, 1973. The orange flashing light on the turret roof is a mandatory fitting for tracked vehicles in Germany.

The Chieftain was conceived in 1951 under the designation Medium Gun Tank No. 2. It was intended to replace both the Centurion Medium and Conqueror Heavy Tanks and to enter service in the late fifties following the completion of Conqueror production which was due to end in 1957. The basic aim was to combine the armour protection and firepower of Conqueror with the mobility of Centurion.

Detail design work began at the Fighting Vehicles Research and Development Establishment in 1953 but development was delayed by the requirement to achieve a degree of commonality with the American T95 design to succeed the M48 Patton series. Further delays were caused by the NATO decision in 1957 to adopt multi-fuel engines for AFVs capable of running on a range of different fuels. This necessitated a change from the proposed V8 engine and Leyland Motors were tasked with designing a multi-fuel powerplant based on a Junkers Jumo aircraft engine, under the designation L60. The configuration of this engine, while attractive from a space point of view, necessitated the complete redesign of the engine compartment with an increase in weight of approximately one ton.

By now, the gun and armour configuration had reached an advanced stage of development. Several technical innovations were applied to embody the powerful 120mm main armament and heavy armour protection required within the weight limitations imposed of 45 tons, later increased to 50. The excellent ballistic shape of Chieftain's glacis plate echoes that of Soviet heavy tanks. Indeed, a JS-2 had been found in 1945 buried under a house in the British sector of Berlin which otherwise was completely devoid of Soviet military equipment. A supine driving position was adopted in order to reduce the height of the hull and consequently the tank's silhouette and weight. The ballistic protection afforded by the configuration of the turret front is exemplary. It was achieved by eliminating the conventional external mantlet of the main armament in what is known as a "mantlet-less turret". However, the installation of the 120mm gun posed serious problems in the stowage and loading of such large and cumbersome rounds. These were overcome by adopting the naval practice of bagged charges whereby projectile and propellant are loaded separately. The bagged charge is completely combustible on firing and has the added advantage that no brass cartridge cases are deposited in the turret exuding noxious fumes and requiring subsequent disposal. All the bagged charges are stowed below the level of the turret in waterjackets which, if penetrated, douse the charges with water reducing the risk of fire and explosion.

In 1958 Vickers Armstrong of Newcastle became design parents of the turret while Leylands pressed forward with the development of the L60 engine. In March 1959, the configuration of the Chieftain mock-up was accepted by the Army. The first prototype ve-

hicle was completed in September incorporating a low power engine as insufficient test bed running had been possible in the short development time. Consequently there were many automotive problems and numerous modifications were necessary with a further weight penalty which had risen to 49½ tons. During 1962, troop trials were conducted in BAOR and the UK by 1st and 5th Royal Tank Regiments of the preliminary production batch of 40 vehicles, designated Chieftain Mk 1.

Although the Army held deep reservations as to its automotive performance and inadequate power output (115bhp below the 700 specified), Chieftain was accepted for service on 1 May 1963 to enable production to begin. In the meantime, Leylands were awarded a post-development contract to correct the engine defects and increase the power rating. Production of Chieftain was undertaken at Vickers Armstrong and at the Royal Ordnance Factory Barnbow in Leeds. Engines suitable for operational use, the L60 Mk 4 A2 of 650bhp, were not available until 1966. They were installed in the first vehicles built to production standards designated Chieftain Mk 2 which entered service with the 11th Hussars in November 1966.

Despite the initial fears of its lack of power, Chieftain proved to be faster than its predecessor and fairly reliable. The awesome firepower and extreme accuracy of the L11A2 120mm gun won immediate approval and new gunnery techniques were evolved to match its long range fighting ability. A total of 532 Chieftains Mk 2 were built for the British Army.

In September 1969, the Mark 3 was introduced with further modifications to the main engine and auxiliary generator to improve reliability as well as a new commander's cupola. By now the requirement for the multi-fuel capability had been dropped (as it had throughout NATO) and henceforth Chieftain was powered by diesel fuel alone. Development of the L60 engine continued in order to increase reliability and power output to 750bhp to meet the requirements of overseas customers who had expressed an interest in Chieftains.

Both Israel and Libya had evaluated the tank but, despite firm orders from both countries, they were denied delivery by the British Government for political reasons. At the time of the Six Day War in 1967, two Chieftains were undergoing trials in Israel. When

Rear view of Chieftain Mk. 5. The armoured box across the width of the hull houses the main engine silencers and exhausts. The third, smaller exhaust pipe is that of the H30 auxiliary engine.

Chieftain Mk 6. The Mark 6 is similar to the Mark 2, but with an uprated powerpack, modified ranging gun and numerous detail changes such as revised handling and turret stowage bins.

Chieftain on night firing ranges - with searchlights and red lamps indicating live firing.

hostilities broke out, the Foreign Office in London despatched frantic cables to Tel Aviv demanding that the Chieftains be moved from the border areas so as to forestall Arab accusations of collusion. The nervous diplomats were perhaps reassured when a laconic reply was received from the Israel Government stating "Have no fear, we have moved the borders".

By 1970, engine reliability had been improved with the L60 Mark 6 but output was still limited to 650 bhp. This engine,with other improvements,such as a new NBC filtration pack and laser rangefinder,as well as a number of modifications suggested by the Israelis were incorporated in the Mark 3/3. Production of the L60 Mark 7 with an output of 720bhp began in 1971 and this engine was installed in Chieftain Mk 5.

In the same year, Iran ordered 780 Chieftains of which 73 were Marks 3/3(P), the P standing for Persia, and the remainder Marks 5/5(P) (FV4030 Phase 1). They differ from the standard British Army version only in detail and have such refinements as an automatic transmission to simplify crew training. A further order for 150 tanks of this mark and 71 Armoured Recovery Vehicles followed in 1975. After comparative trials against the M60A1 and AMX30, Kuwait also ordered 150 Chieftains, Marks 5/5(K), in 1975.

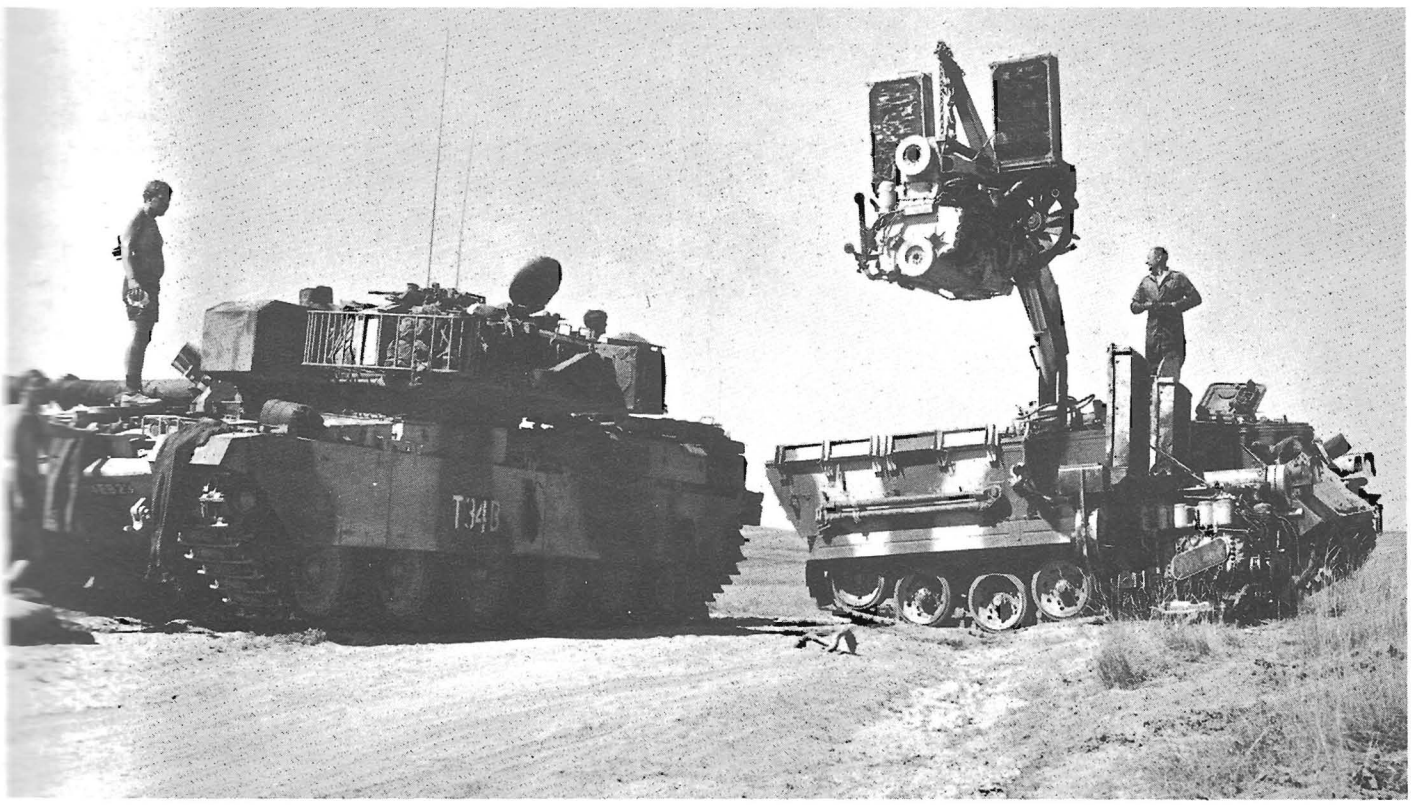
The continual quest for greater engine output, however, gave rise to a number of serious problems and reliability, which formerly had been adequate, was now unsatisfactory. Besides recurring engine failures due to cracking of the cylinder liners, piston ring breakages and failure of the cylinder lip seals, new faults appeared such as cracking of the rear gear cases. Pending a solution to these problems, the Mark 7 engine was derated below 700 bhp. Cylinder liners of improved material with better thermal and wear pro-

perties together with new piston rings were introduced in September 1974 in Mark 7 engines. By the latter half of 1975, the L60 Mark 8 of 750 bhp incorporating all previous modifications was in production for overseas customers. Subsequently in late 1977, an improved method of sealing between the liners and cylinder block, colloquially known as "tight fit liners", was developed and trials met with considerable success. All these modifications have now been incorporated during engine rebuilds in a number of fancifully named programmes such as "Totem Pole" and "Sundance". The fully modified "Sundance" engines are designated Mark 9 and have achieved remarkable mileage between failures. The low power output and persistent unreliability of the L60 engine which plagued Chieftain for so long have finally been rectified and it now has an engine to match its other undoubted assets.

While Chieftain's automotive performance has greatly improved, its fighting ability and protection have been similarly enhanced. The success of any tank in battle depends on numerous factors, the most important being speed of engagement. The tank that

Chieftain supporting infantry attack at Bovington training grounds – in the rear a Saladin armoured car acting as "enemy".

L60 engine change in the field at Batus. The broken fan belts suggest a failure of the cooling fan sprag clutch, a perennial problem of the L60. Note the early type No. 2 NBC pack on the turret rear. This, together with the twin headlight units, indicate a Chieftain Mk. 3.



fires and hits the target first is the one that will survive. The long range capability of the 120mm gun confers an immediate advantage to Chieftain but without an efficient fire control system and sighting equipment this advantage would be lost. Chieftain possesses excellent optical devices that allow the commander to acquire targets rapidly under all battlefield conditions. Coupled with the proven gun control equipment providing stabilisation in azimuth and elevation, Chieftain has the ability to fire accurately on the move. However, the single most vital factor in tank gunnery engagements is range estimation. The flat trajectory of the high velocity 120mm APDS round enables targets out to 1200 m to be engaged directly but, at greater ranges or when using other types of ammunition, additional factors such as aim-off and dispersion must be taken into account. Originally, Chieftain was equipped with a 0.5" ranging gun to establish range to target but, as it was only effective to 1800 m (later increased to 2500 m), it somewhat negated Chieftain's ability to fight at extreme ranges. The introduction of the laser rangefinder in Mark 3/3 (subsequently fitted to all Chieftains except Mark 1) enables the gunner to establish precise and accurate range data out to 10,000 m, beyond the distance of any foreseeable tank engagement. The introduction of IFCS (Improved Fire Control System) exploits to the full the potentiality of the 120mm gun. The highly automated IFCS allows extremely accurate and rapid laying of the main armament and targets may be engaged in as little as 3 seconds with a high probability of a first round hit. The 120mm has been further enhanced by the introduction of a new range of improved ammunition including an APFSDS (Armour Piercing Fin Stabilised Discarding Sabot) round of immense lethality.

Since WW2 British tank designers have placed armour protection high in the firepower, protection and mobility equation while the European school of thought, characterised by the AMX30 and Leopard 1, advocated high mobility as a substitute for passive protection. Recent conflicts in the Middle East have vindicated the British formula and current designs under development in Germany and the USA reflect a similar configuration in terms of firepower and protection as Chieftain. At a combat weight of 54 tons with its highly sloped heavy armour, Chieftain has superior protection to any other tank in service.

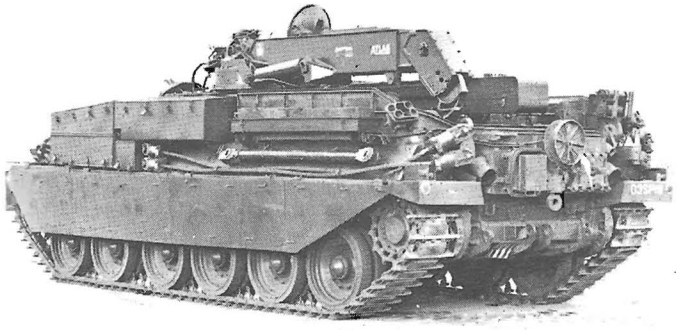
One of the major problems of such a large-calibre main armament as the 120mm is obscuration on firing. (Obscuration is the effect of dust thrown up by the muzzle blast which makes it extremely difficult for the commander to ascertain whether the target has been hit.) Conversely, if one cannot see the enemy, he cannot see you; this allows a tank to withdraw rapidly to a new fire position undetected – a vital factor when engaging a numerically superior force.

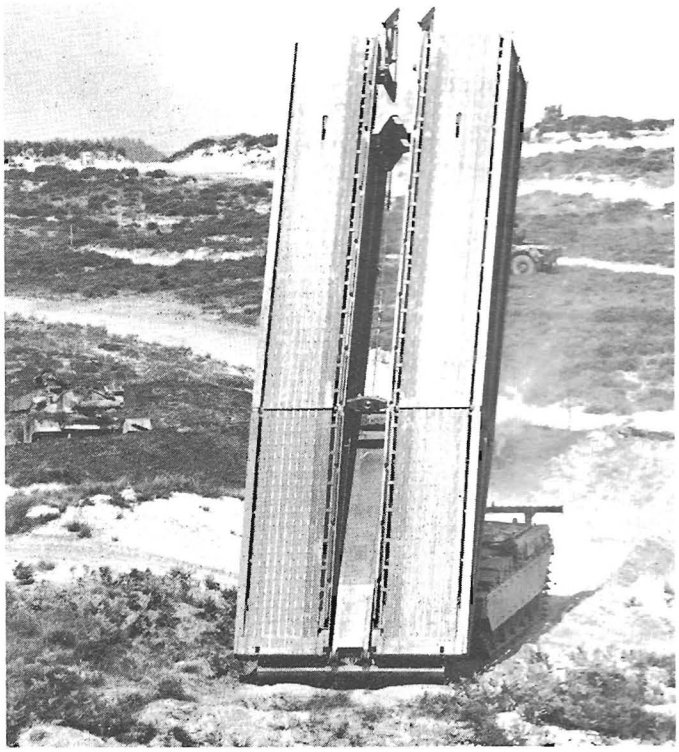
This does not, of course, belittle the importance of mobility but, on the battlefield, opposing tanks manoeuvre relatively slowly, jockeying for positions from one piece of dead ground to another. Therefore, high acceleration is preferable to a high road speed, so as to present a target for as short a time as possible when moving in tactical bounds. Consequently, research has been devoted to improving this aspect of Chieftain's mobility. It is evident that the Leyland L60 has reached the limit of development and a Rolls Royce V12 diesel engine of 1200 bhp has been designed. This engine was originally proposed for an improved version of Chieftain (FV4030) for the Iranian Army with the name Shir Iran (Lion of Iran) and also for retrospective fitment in existing Iranian Chieftains at a rating of 800 bhp. Two types had been called for, the Shir 1 incorporating the new engine, and the Shir 2 which also has Chobham armour. Following the revolution in that unfortunate country, the contract for 1200 Shirs was cancelled. The combination of the Rolls Royce CV12 TCA engine and David Brown TN37 automatic transmission gives a high power to weight ratio of 20 hp/ton while the development of a hydropneumatic suspension system exploits the increased power available, giving a high sustained cross-country speed and acceleration without discomfort to the crew.

Chieftain on exercises at Batus Ranges, Canada.

The principal advantage of the Chieftain ARV over its predecessor is its ability to recover casualties to the front.
earth anchor and winching equipment are controlled by the drive.

Chieftain Mk 5 ARV(P). This version, equipped with an ATLA AK6000M crane, was developed for the Iranian Army. It is probable that a similar version will enter service with the British Armv.





Chieftain Bridgelayer (FV42005) in action. Note MBT in the background gives covering fire during the sequence (above).

The immense span of the Chieftain AVLB (Armoured Vehicle Launched Bridge) is apparent from this photograph. The No. 8 Class 60 Tank Bridge is currently the longest AVLB in the world (next page, 1, 2, 3).
Using a Centurion No. 6 Tank Bridge as a platform, the Chieftain Bridgelayer of 23 Engineer Regiment demonstrates the technique of 'double bridging' which increases the bridging distance considerably (next page, 4).

Prototype of Chieftain AVRE (Armoured Vehicle Royal Engineers). The Chieftain AVRE was similar in configuration to the ARV, but featured mounting arms for a fascine or Class 60 Trackway. The AVRE did not enter service, a victim of perennial defence cuts.


T32B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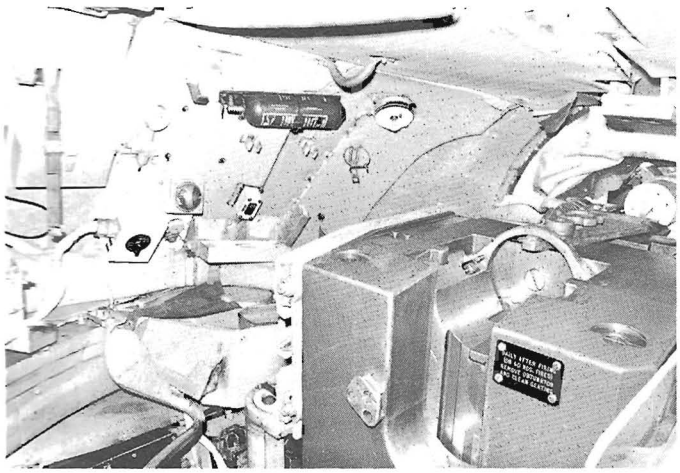
Chieftain on exercises in BAOR – with firing simulators mounted.

latest designs such as the Leopard 2 and XM1, which are still to enter service. Unlike the Germans or Americans, who have had to design completely new vehicles so as to maintain qualitative superiority over the Soviet numerical superiority in tanks, the British have built on the bedrock of a sound original design and Challenger represents a formidable combination of firepower, protection and mobility at a reasonable cost and without recourse to unproven technological innovations such as the gas turbine engine.

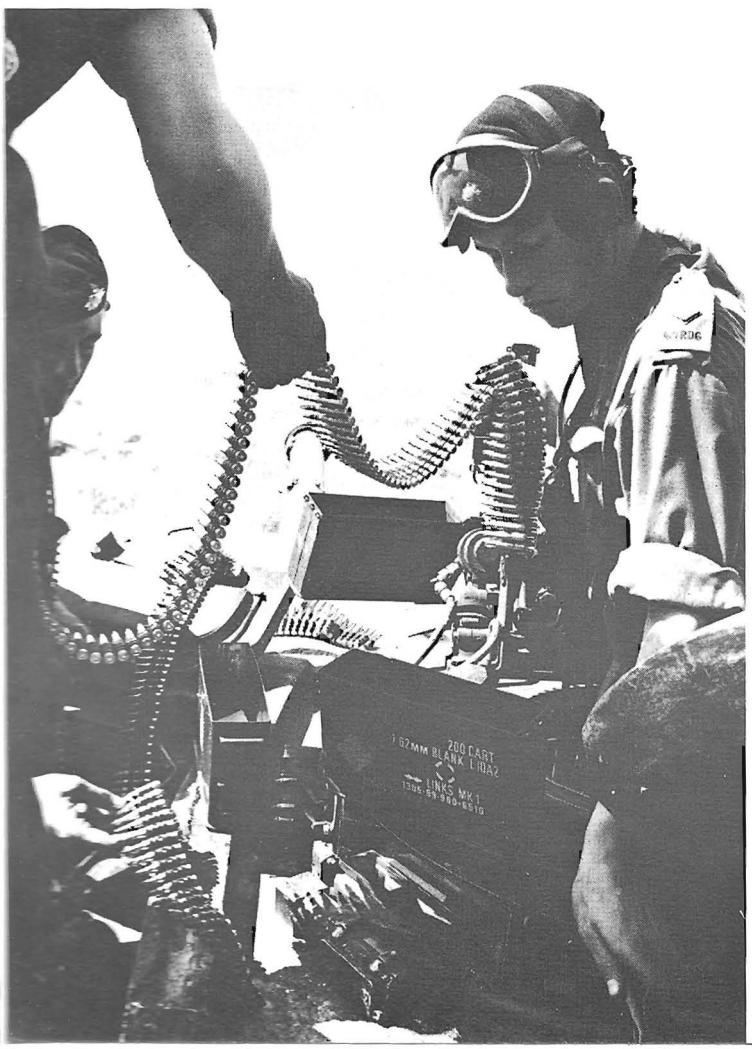
'Dazzling', Chieftain of 4 RTR. As the majority of modifications during the life of Chieftain have been to the fire control system and automotive components, not all marks can be easily differentiated from the exterior. Note the armoured shutter over the gunner's periscope that allows him to replace damaged optics or substitute night sights without exposing an aperture to enemy fire.

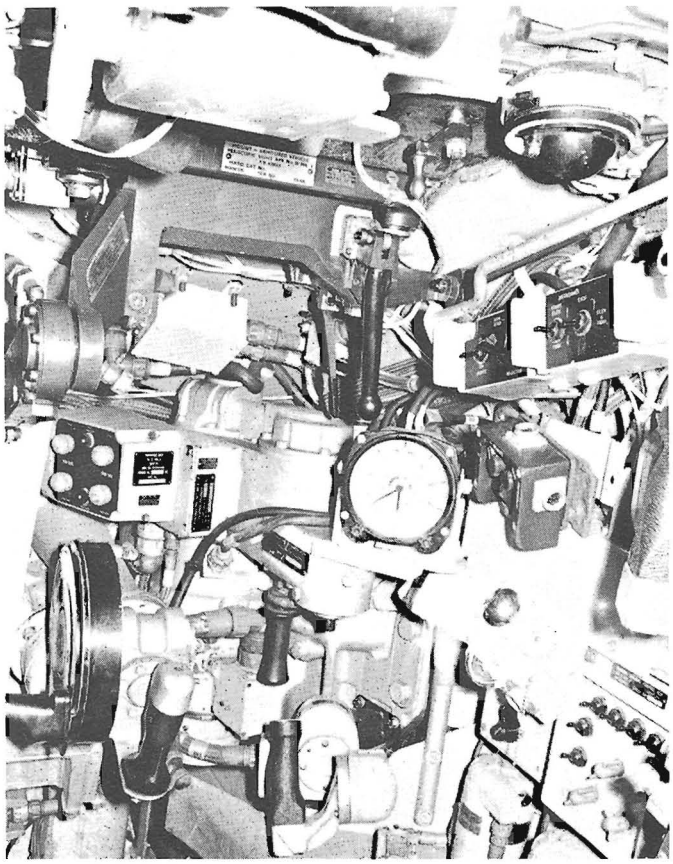


Loader's position beside the massive 120mm breech. Note the suppression bagged charge container in the lower centre of the picture.

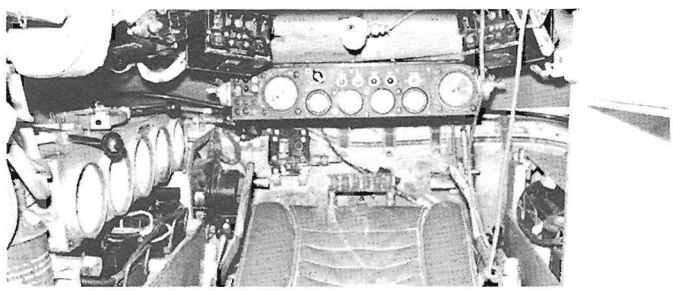
Gunner's position showing the complexity of the fire control system. No periscope is fitted to this vehicle.

Loading the cupola machine gun prior to a battlegroup exercise at Suffield. The L37A1 7.62mm cupola-mounted machine gun may be fired from under armour without exposure of the commander. The machine gun automatically ceases firing when five rounds remain in the belt, allowing the commander to reload without opening his hatch, thus preserving NBC protection from enemy fire.

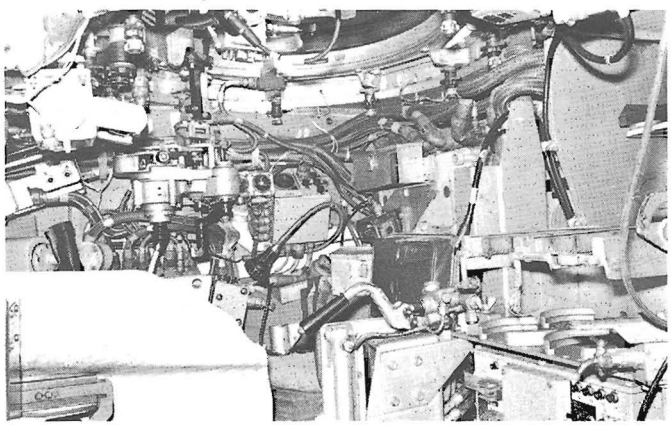


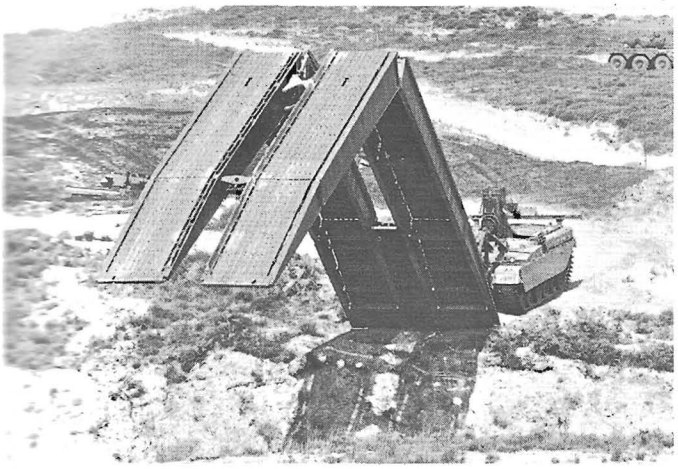


Driver's position surrounded by all the paraphernalia of a modern AFV with batteries to either side as well as stowage bins for main armament projectiles.



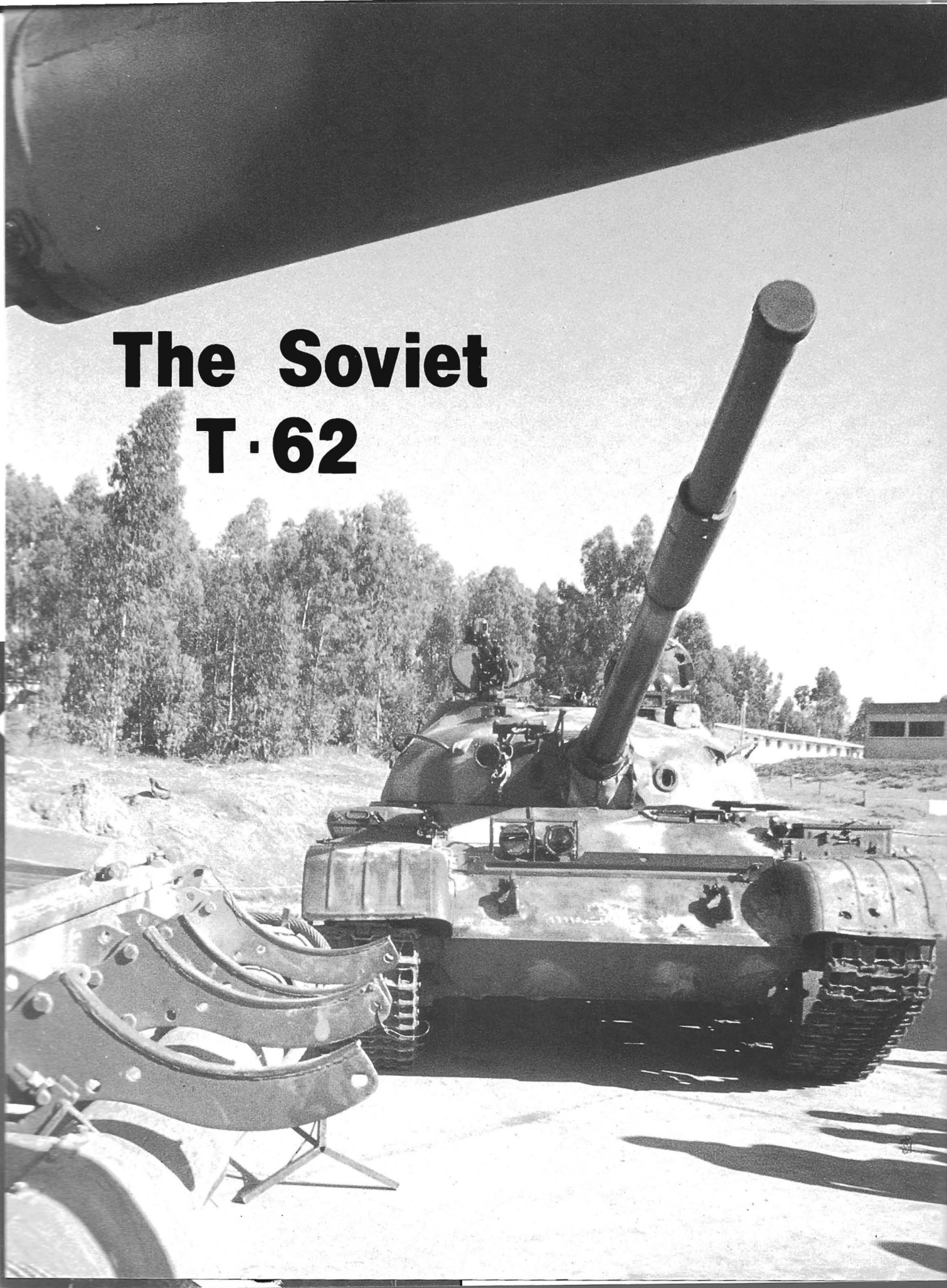
Commander's position with the numerous 'black boxes' and intricate electronic 'plumbing' characteristic of modern MBTs. The abundance and diversity of such sophisticated equipment in a modern AFV places a fearful workload on the tank crew.





The crew of a Chieftain Mk. 2 of 17th/21st Lancers enjoy a cup of tea as they wait for recovery having 'bogged in heavy terrain. The metal screen between the headlights serves as a splashboard during wading and as protection to the driver when hatch is opened up against objects such as ice flows or tree trunks from riding up the glacis plate.

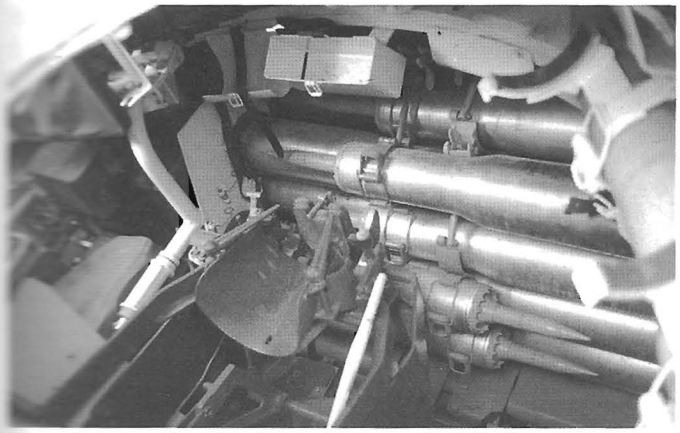
The Soviet T·62



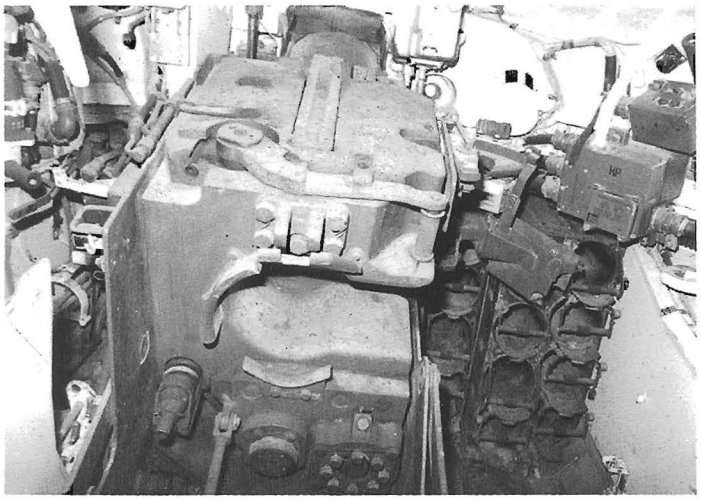
ORIGINS AND EMPLOYMENT

Still the standard Main Battle Tank in the Soviet armed forces, gradually being replaced by the T-72 with priority for the Group of Soviet Forces Germany, the T-62 was a development of the T-54/55 series and entered production in the early sixties. First presented during the May 1965 parade held in Moscow, some 40,000 units of this tank are believed to have been produced solely by Soviet tank industires; no other Eastern Bloc countries have been granted a production licence for this vehicle, so that the three giant Soviet tank plants have averaged a production of 2,400 per year for over 15 years. One of these is still producing the T-62, while the others have converted to the production of the T-64 and T-72, of which the former is also now being phased out. Since the seventies, most Soviet first-line units have been

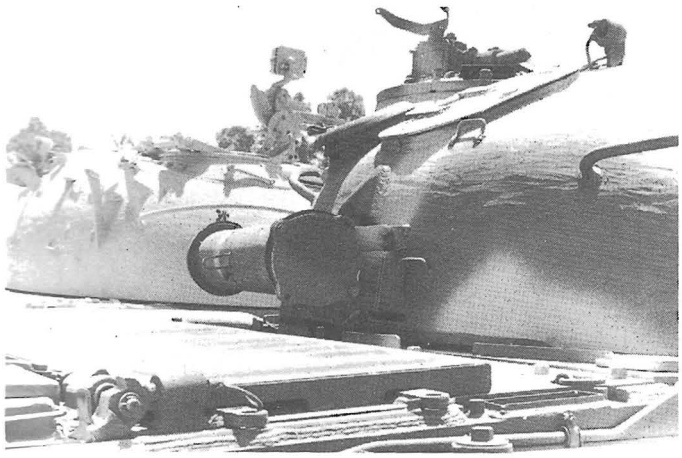
T-62 interior – showing the U-5T 115mm gun breech block and loader's position and ready ammunition stowage. Also note the radio-intercommunication control boxes. On the left is the gunner's position partly showing optical equipment.



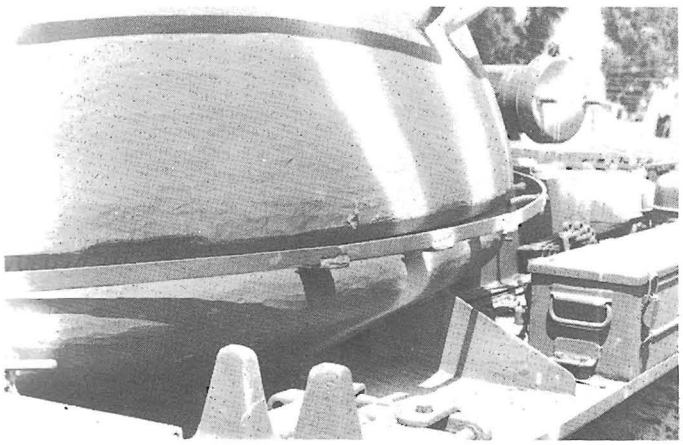
APFSDS ammunition stored in the sides of a T-62 turret.



T-62 captured during the Yom Kippur War on display at the Israel Armour School.



Close-up on the rear of T-62 turret with cartridge ejector port closed and engined deck.



equipped with this tank. Curiously enough, none of the other Warsaw Pact countries have included the T-62 in their inventories, although the Soviets have supplied Syria with over 1,200, Egypt with 750, Iraq 600 and Libya several hundred. The complete absence of these particular types in East European countries has been little publicised but may have interesting implications if the technical and tactical merits of this tank are examined in detail, as in the following pages.

In this respect, another matter comes to light, namely that East European countries of the Warsaw Pact have not until recently included the T-72 in their arsenals, nor have they equipped with its forerunner, the T-64, which they ignored completely.

The Soviet satellite countries have, therefore, preferred to remain with the T-55 since the fifties, and several modifications were made in the Polish and Czech T-54/55 types manufactured there. It remains to be seen if similar modifications will be made in the Polish and Czech tank factories now producing the T-72.

According to statistics, there must be over thirty thousand T-62s in service with the Soviet armed forces. Of these, close to 5,000 were stationed with units

Soviet T-62A on display in the THREAT corner at Grafenwaer USAREUR training center, West Germany. (Note the raised loader's hatch and DShK 12.7mm AAMG – the main identification for the T-62A type.)

of GSFG (East Germany). In 1979, the Soviets announced the withdrawal of 1,200 tanks, which turned out to be training tanks, not belonging to first-line formations, which had been replaced with T-72s. As the present replacement programme continues, the phased-out T-62s remain in storage for reserve units, or continue to serve regular units for training exercises, saving running hours for the new T-72s which are kept in peacetime storage.

This vast number of T-62s available presents an inexhaustible source for the supply and build-up of friendly nations, such as the Arab countries, and partly explains the rapid rebuilding potential which restored the vanquished Arab armies during and after the Yom Kippur War. It also presented, albeit reluctantly, a source of supply to Iraq, though implemented mainly through third parties.

Many secrets of the T-62 became known following the Yom Kippur War, when hundreds of Egyptian and Syrian T-62s were captured by Israel. The detailed examination of its technical innovations, as well as its tactical shortcomings, was made possible by thoroughly researching all the material available.

OPERATIONAL RECORD

Several hundred T-62s served with the Arab armies during the Yom Kippur War. As part of the rebuilding programme of the Syrian and Egyptian armies, T-62s had been supplied by the Soviet Union to both countries, as well as Iraq, during the late sixties and early seventies. Equipping the independent armoured brigades which were attached to the infantry divisions and followed them into the bridgeheads, the T-62s were badly mauled in two tank battles taking place on both flanks of the Israeli bridgehead near Deversoir on 17 October, 1973. In these battles the 25th Armoured Brigade was totally destroyed on the shores of the Great Bitter Lake by Major General Adan's division, while a brigade of Major General Sharon's division beat the 24th Armoured Brigade on the northern bridgehead perimeter near the Chinese Farm complex. In both battles close to 100 T-62s were destroyed. Another clash with T-62s took place earlier, as the 15th Armoured Brigade clashed with Israeli T-55s near the Firdan/Kantara sector. Further to the independent brigades, the crack 4th Armoured Division, which mostly remained at Jebel Oubed, west of Suez, was also equipped with T-62 tanks, but only a few of these saw action.

Syrian T-62 tanks being towed out of the Valley of Tears on the Golan following their capture by the Israelis. Note special camouflage pattern. This picture gives an excellent upper view of the tank turret and hull.

In the Syrian Army, most of the tank brigades of two armoured divisions, the 1st and 3rd, were equipped with T-62s, as was the crack independent armoured brigade commanded by the Syrian President's brother Rifaat. The Syrian T-62s caused great concern to Israeli tankers, especially those of the 7th Armoured Brigade, as they were fitted with sophisticated night vision equipment which gave them an enormous advantage over the Israeli Centurions, at the time completely devoid of these systems. However, in the close-in fighting battles which raged over the Golan Heights for three days, the Israeli tankers found out that the T-62 could be beaten decisively; only later did they find out why.

DESCRIPTION

The hull is an all-welded rolled-steel construction with the turret a one-piece casting. Like most Soviet armour, this is of standard homogeneous steel, mostly chrome-manganese-silicon heat-treated for high hardening process. The hull is divided into four sections separating with armoured bulkheads the driver's position, the fighting compartment, (turret) engine and transmission compartments. There is an escape hatch to allow the driver to enter the turret; however, this involves a difficult manoeuvre even under the best circumstances. The driver's hatch cover opens by swinging to the left. In front of the glacis plate there is a splash-board preventing water from rushing up the hull while fording water obstacles.

Iraqi T-62A entering Qasr-i-Shirin in October 1980 during the Iraqi-Iranian War.

The tank's powerplant is an improved version of the V-55 engine used in the T-55, but it has similar characteristics. Ultimately a development of the basic W-2 diesel engine used in the T-34, the engine mounted in the T-62 is designated V-2-62 and is constructed of light alloys where possible. Water cooled, the V-12 diesel produces 580 HP at 2000 rpm. Transmission is identical with the T-55. Steering is manual, five forward one reverse speed. Clutch operation is air-assisted, reducing somewhat the arduous job of gear shifting, notorious in Soviet tanks. Indeed, clutch failure causes close to half of all T-62 breakdowns, impossible to repair in the field by combat maintenance crews. At relatively low speed (30 km) the tank handles badly because of steering problems.

Bad ventilation of the cramped driver's compartment causes fatigue, which reduces the combat capability of the tank under battle conditions. This inconvenience grows under extreme climatic conditions such as deserts or steppes. If the driver's hatch is kept open, a safety device prevents the turret from traversing.

Human engineering of the T-62 is bad all over, and little, if any, improvement of the difficult conditions in the T-54/55 has been made here. In the fighting compartment – the turret shape, being even flatter than the T-55, lower by a few important centimeters, allows less headroom in the cramped positions the turret crew members have at their disposal. (The T-72 crew members are even worse off: their headroom is reduced by an additional 15 cm!). The commander's cupola has four vision blocks. A day/night binocular-type periscope with an integral IR capability, designa-

ted TKN-3, is mounted forward. Daylight magnification is x5 with a 10° field view and night magnification is x4.2 with an 8° field of view.

The gunner has a TSh2B-41U telescope with rotating vehicle for superelevation required for the different types of ammunition. With a x3.5 magnification and 18° field view a stadiametric rangefinder is fitted for maximum ranging at 4000 meters for APFSDS and 4800 meters for HEAT ammo. The night vision equipment is of a high standard; it performed extremely well on the Golan Heights in the October War. Late version models have improved 900 meter range IPN-22 MI optical systems to detect IR sources. A main 200 watt L-2G searchlight, mounted to the right of the main gun, can emit white or IR light by means of filters.

The T-62 has a torsion-bar Christie-type suspension with hydraulic shock-absorbers on the first and last of the five dual rubber-tyre road wheels on each side, along with a compensating idler and a rear drive sprocket. As is customary with other Soviet tanks, the all-steel track has pins that are not secured at the

T-62 fording water obstacle with snorkel.

T-62A MEDIUM TANK

Weight: 40 tons s
Crew: 4 (driver, gunner, loader and commander)
Length, overall: 9.335 m
Length of hull: 6.63m
Width: 3.30m
Height: 2.395m
Ground clearance: 432mm

Fuel capacity:
Internal: 675 litres
Basic external: 285 litres
Supplementary external: 400 litres
Fuel consumption:
Road: .30 litres per km)
Range: 300-450km
Maximum speed: 50km/hr
Maximum gradient: 30°

Trench crossing: 2.85m
Vertical obstruction: 80cm
Unprepared fording: 140cm
Snorkelling: 5.5m
Ground pressure: 0.72kg/cm^2
Engine: V-55 diesel; 580 hp at 2,000rpm; V-12; water-cooled

Fire control and vehicle vision devices:
Commander: TKN-3 designator sight
Gunner: TSh2B-41U telescope; an infra-red TPN 1-41-22M periscope. Some vehicles are fitted with an infra-red IPN-22M passive starlight scope with an effective range of 700-900m.
General: An infra-red L-2G main searchlight with OU-3GK searchlight on commander's cupola.

Armour:
Glacis plate: 100mm
Upper hull side: 70mm
Mantlet: 170mm

Armament:
Main gun: U-5T 115mm smoothbore gun with two-plane stabilisation; -3° to + 17° elevation
Ammunition stowed: 40 rounds
Ammunition: BR-6 APDS projectile/round weight 6.8kg /22.5 kg, initial muzzle velocity 1.615 m/sec
BK-6 HEAT projectile/round weight 11.8 kg/26.2 kg, initial muzzle velocity 1000 m/sec.
OF-18 Frag-HE projectile/round weight 17.7kg/18.1kg, initial muzzle velocity 750m/sec.
OF-11 Frag-HE projectile/round weight 17.7kg/28.1kg, initial muzzle velocity 780m/sec.
Armour penetration: BR-6 APDS fired at 1000m at 0°/60° 228mm/199mm; fired at 2000m at 0°/60° 147 mm/129mm.
BK-6 HEAT fired at 1000m at 0°/60° 495mm/248mm; fired at 2000m at 0°/60° 495mm/248mm.
Supplementary armament: Coaxial PKT 7.62mm machine-gun; 12.7mm DShK anti-aircraft machine-gun; 2,200 rounds of 7.62mm and 500 rounds of 12.7mm ammunition stowed.

Soviet T-62 company on a wintry road in East Germany.

Rumbling forward through the dust is a formation of Soviet T-62s.

outer end and are free to travel towards the hull. A raised piece of metal welded to the hull just forward of the sprocket drives the track pins back into position each time they pass. This makes the distinctive clank which is so familiar in Soviet tanks since the T-34. Despite these safeguards, the T-62 frequently throws its tracks. Czech solutions to this deficiency, widely known on the T-55, include a track-retaining plate; this may also have been adopted for Soviet T-62s.

MODIFICATIONS

A T-62 model has a loader's hatch added, to mount a 12.7mm DShKM machine gun for anti-aircraft defence, probably as a result of the Yom Kippur War experiences. The T-62 M, which appeared late in the seventies, is a T-62 A with the drive sprocket and track of the T-72. The T-62 K is a command tank version with reduced ammunition storage, replaced by an auxiliary generator for additional power source for radio equipment as well as a TNA-3 land navigation system. Finally, there is the T-62 T model.

ARMAMENT

The T-62 mounts the 115mm smooth-bore U-STS (2A20) gun firing HVAPFSDS, HEAT and HE fragmentation rounds. The HVAPFSDS ammunition uses steel penetrators with fins, opening as the sabot falls away to give stability in the absence of the spin stabilisation of the projectiles fired from rifled barrels with a muzzle velocity of 1615 m/sec (more than four times the speed of sound). The flat trajectory gives high accuracy within combat range; however, it makes it impossible to follow the flight path with the eye and is therefore difficult to aim. The Soviet smooth-bore technique preceded Western technologies in this field by almost twenty years; however, the deficiencies in optical and electronic devices to overcome aiming difficulties are still evident. The U-STS 115mm gun is laid out for short or medium range operation and within this sphere it excels. For this a basic stadia reticle is more than adequate for range-finding, with aiming through a graduated telescope. This extremely practical and workable solution is preferred for use in normal combat ranges and stands out in sharp contrast to the somewhat oversophisticated Western technologies in this field. The inclusion of a ballistic computer now increases the long-range capacity of the gun, but here its qualities fall off sharply.

T-62 during field exercises advancing with BMP-1 (note absence of Sagger missiles on the racks).

T-62 tank leading a company of T-54s on training exercises in eastern Europe. Note absence of AAMG and raised loader's hatch on this earlier model.

Many drawbacks are evident on closer examination. The gun's exhaust fumes are overwhelming and the fighting compartment fills with carbon monoxide quickly, despite the bore evacuator put there to remove these deadly fumes. Even more disturbing is the ineffective operation of the automatic cartridge ejector, which frequently becomes improperly aligned with the ejection porthole in the rear of the turret. This is often caused by high speed vibration throwing the mountings off balance. The result is deadly. The brass containers rebound off the turret wall and ricochet at high speed around the cramped turret interior. Apart from the commander, who is fortunate in being provided with a protective shield, the gunner and loader are unprotected against these hazards. This may be the main cause of an extremely low rate of fire, less than four rounds per minute against the seven officially prescribed for the 115mm gun.

Another defect is the loading sequence, which requires vigorous force to shove the round into the rapidly horizontally closing breech. As the gun is elevated during the loading process, all power is cut off to prevent accidents until the loader has chambered the round and depressed the safety button to fire.

The T-62 therefore fires less quickly than many Western tanks and at longer ranges the efficiency of its gun falls off sharply, whereas Western tanks with better rangefinding equipment have increased efficacy within these ranges. However, as most tank engagements take place within the 1500 meter range, the U-STS is a most effective weapon with a high first hit/kill capability. The Israelis, impressed with the Soviet gun's performance, have included some 150 T-62s in their inventory, reportedly retaining the 115mm gun, whereas they replaced the 100mm gun of the captured T-54/55 with their own L7A1 105mm guns. The T-62 is a remarkable, although far from perfect tank.

Egyptian armoured brigade lined up for inspection. The Egyptian Army still fields 750 T-62s, but it is doubtful how many are operational.


M-60

M60. The visual differences between the M60 and the M48 series are readily apparent in this photograph. The 105mm gun has no muzzle brake or blast deflector and an eccentric fume extractor; the glacis plate is flat and the front edge of the hull straight; the turret side has a perceptible bulge to accommodate the larger M19 commander's cupola. Among the many changes of detail are the reinforced headlight guards; the crew heater exhaust pipe vents to the left (of picture) instead of right; the stowage bins extend the full width of the trackguard. On the top right of the glacis plate are the exterior fire extinguisher pull handles.
(US ARMY)

Both the diesel engine and the 105mm gun were installed in the M48A2. This, with the addition of other components, was standardised in April 1959 as the M60 Main Battle Tank. The classification "medium" was dropped in favour of the term Main Battle Tank, as the M60 was intended to replace both the M48A2 Medium and the M103 Heavy Tanks. In June 1959 a contract was placed with the Chrysler Corporation for 180 M60s. These were built, starting in October, at the Army Ordnance Plant, Newark, Delaware, as a continuation of the M48A2 programme. After extensive trials, an order for a further 720 followed, to be built at the Detroit Tank Arsenal, Center Line, Michigan – where the M60 series are built to this day. The M60 entered service with the U.S. Army in November 1960. The definitive production model, the M60A1, appeared in the spring of 1962. This has a wider turret to accommodate the two-metre base coincidence type rangefinder and an elongated nose giving greater ballistic protection. 200 M60A1s have also been built under licence in Italy by OTO Melara.

Reliability is greatly improved over previous tank the Mean Time Between Failures (MTBF) of 30 hou or 960 kilometres is probably superior to all conten porary tanks. In common with the majority of Amer can tanks, ease of maintenance is good; almost a servicing and repair may be undertaken at unit lev with the minimum of special tools and expensiv diagnostic equipment. For example, the M60 powe pack may be changed in the field in under four hour Such a policy ensures maximum availability of tank with as few 'deadlined' or undergoing major overha as possible.

Firepower is markedly improved with the adoptio of the 105mm gun and APDS (Armour Piercing Di carding Sabot) supplementing HEAT as the main a mour piercing round. The M60 carries 60 rounds o 105mm ammunition and the M60A1 63 rounds.

Apart from the main armament, the most obviou change from the M48 series is the larger M19 com mander's cupola, mounting the standard M2 or th short receiver type M85 .50"calibre machine gun.

A column of Israeli M60A1s churning the desert sands near the Tassa-Ismailia main road. ▲

M60A1s during Reforger 74. Following the unprecedented losses of tanks during the Yom Kippur War of 1973, the Israelis were resupplied from Reforger stocks in Europe. This created a serious drain on the US Army tank inventory which could not be readily replaced due to the limited production rate of M60A1s at that time. ►

M60A1E3 on the firing range. ▼

During the dry season, the all-pervading dust proved especially troublesome, choking air cleaners and clogging oil cleaners. Without frequent cleaning and maintenance, the abrasive dust considerably shortened the life of all working parts of the tanks. In the monsoon season, the greatest obstacle to mobility was the glutinous mud. This frequently caused thrown tracks, contaminated lubricants and fuel supplies, and obscured suspension defects, preventing regular maintenance. Further, the ever-present damp made life for the crews miserable.

Although criticism has been levelled at the relative lightness of the main armament of a 48-ton tank, the M48A3's 90mm was more than equal to the task in Vietnam. No benefit would have accrued by employing the more expensive 105mm calibre of the M60 series or by upgunning the existing M48s. In all the infrequent engagements against the PT76s and T54/55s of the NVA, the 90mm – in conjunction with the efficient fire control system – proved superior.

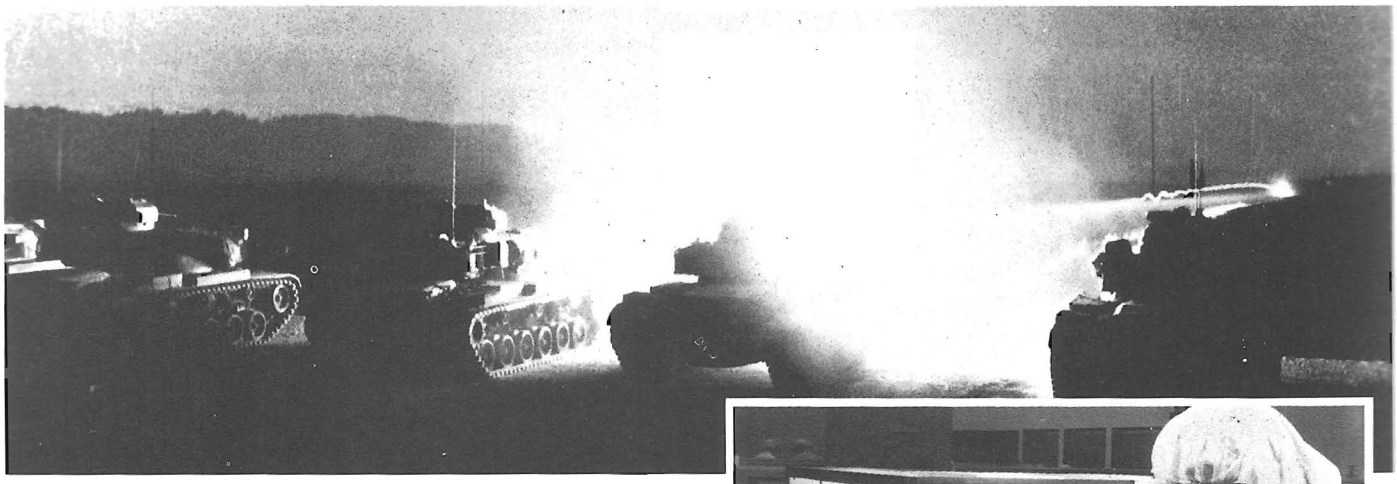
In April 1964 during the development of the M551 Sheridan, it was decided to mount the Sheridan's revolutionary Shillelagh gun/missile launcher on the M60A1.

Prototypes based on existing M60A1s fitted with the new main armament were termed the M60A1E1 and those based on new build vehicles with the Shillelagh as part of the original equipment were designated as the M60A1E2. The first prototype M60A1E1 was completed in September 1965, with a second in November. Early trials revealed a number of serious problems with the turret's hydraulic stabilisation and fire control systems and with the combustible cartridge cases of the conventional ammunition. Despite extensive modifications, the problems were not rectified before the procurement of 300 M60A1E2s (designated the M60A2) was authorised in September 1966.

The 152mm gun/missile launcher fires either a Shillelagh missile capable of destroying all known tanks up to 3000 metres or a conventional HE projectile with an effective range of 1500 metres. The M60A2 carries 13 missiles and 33 rounds of conventional ammunition. Both the turret and the commander's cupola are stabilised in azimuth; the main armament together with the coaxial M73 machine gun and the commander's M85 machine gun are stabilised in elevation. The gunner's sight is also stabilised so that the gunner and commander may engage separate targets simultaneously while the tank is moving. However, as the gunner must have continuous observation of the target, it is not possible to fire the missile on the move. The missile system requires only that the gunner lay his sights on or near the target, pull the trigger and then keep the reticle on the target until impact; the missile being guided by the two-way infrared command link acting on the rocket motor nozzle. The Shillelagh, a single-stage solid-propellant missile with a HEAT warhead, has a velocity of 203 m/sec. giving a flight time of 14 seconds at 3000 metres. The external configuration of the turret casting has been designed on an in-line principle to present the minimum frontal area, thus reducing vulnerability. The commander is positioned directly behind the main armament in a towering cupola that heightens the otherwise commendable silhouette of the tank.

The problems that had plagued the early models persisted; production was suspended until they were resolved. The technical difficulties were associated with the target tracking system. The fearsomely high pressure of the turret power traverse (2000 psi as against 900 psi of the M60A1) caused serious problems of valve wear and filtration, though allowing one complete rotation of the turret in a remarkable 9 seconds. Turret oscillation affected the stabilisation system, leading to wild deviation of the main armament, and the vibration caused loosening of the laser rangefinder sight mounting bolts. The laser also gave inconsistent readings during its warm-up period. In addition, the voltage regulator and generator proved

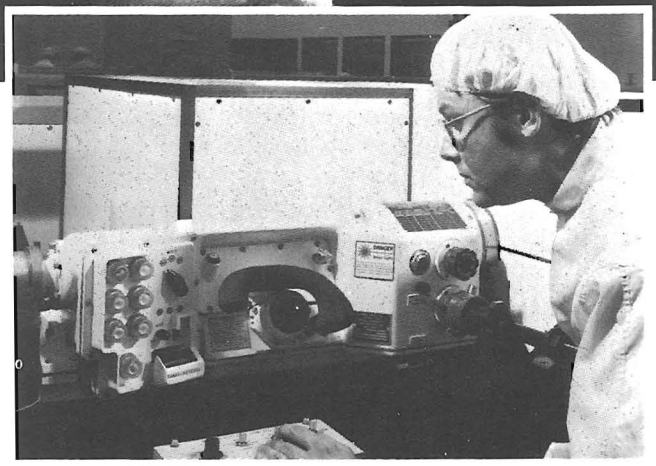
M-60 carries a jeep across the Colorado River in exercise "Desert Strike", 1964 (US ARMY).



M60 A1E2 on night firing range.

problematic and there were persistent faults in the .50"calibre ammunition feed. The complexity of the turret precluded repairs by the crews, requiring a highly qualified specialist mechanic to maintain it.

These problems finally rectified, production was resumed in 1972. The first battalion of 59 M60A2s was formed in 1974, with 54 MBTs per battalion and 5 in reserve. The M60A2 battalions currently deployed in Europe are integrated with the standard M60A1 tank units providing an effective, albeit expensive, long range anti-tank capability. (A total of 526 M60A2s were built and procurement is now complete.)



The laser rangefinder of the M60A3. In operation, the laser rangefinder is aimed at a target and the laser fired. The laser beam reflects off the target and returns providing precise and instantaneous range information, accurate to ± 10m at 10,000m. The fire control system's computer processes the range, along with other data such as wind, temperature and ammunition ballistics, to provide the correct azimuth and elevation to the main armament.

The XM1 General Abrams – successor to the Patton series.

A combined unit of M 60 Pattons and modified upgunned T-54s making ready for action. Note the last tank still with its original 100mm gun.

Until the 1960s, tank production had run at about 60 a month; this was considered the minimum rate to maintain the expertise and industrial capacity which would allow expansion in times of emergency. In 1964, production was cut to 30 a month; by 1973, however, half of these were modifications to M60A2s. In other words, the real rate was only 15, or 180 a year – at a time when the Soviet Union was producing more than 4000 a year. The Army was unconcerned, as the tank inventory exceeded the stated requirements; only 59%, however, were the M60 series with 105mm guns and diesel engines.

Patton tanks took part in the ferocious battles along the Suez Canal during the so-called War of Attrition. At this time the new M60s arrived from the U.S.; Israeli Ordnance then modified the existing M48 to M60 standard, exchanging both engine and gun as well as many other systems. The Pattons comprised most of the regular brigades stationed in Sinai as the Yom Kippur War broke out on 6th October, 1973.

The Yom Kippur War of 1973 altered the situation radically, as the reserves were seriously depleted to meet high Israeli losses incurred during the war. Further demands from foreign armies anxious to increase their tank fleets exacerbated the situation. Many of these requests were met from Army reserves, depleting the tank inventory by more than 2000. To make good these losses it was necessary to increase production. However, tank production capability had been seriously affected by the loss of casting foundries, closed due to the lack of profitability and the effects of the environmentalist-inspired Clean Air Act.

Following the Yom Kippur War, production was increased from 15 to 40 a month; a further increase was necessary when the Army reassessed its reserve requirements. The tank combat loss factor was increased from 8% to 20%; 3000 more tanks were therefore required. In November 1974, the rate was further increased to 100 a month over a two-year period; in the interim, it was decided to upgrade 1,210 of the M48 series to M60 standards by installing 105mm guns and diesel engines. Other improvements include the T142 tracks, top loading air cleaners, coincidence rangefinder and revised ammunition racks. These modified tanks are classified as the M48A5.

In light of the delays in the deployment of the M60A2 and the MBT-70/XM-803, which was subsequently cancelled in 1972, it was decided to upgrade the M60A1 following a design study begun in 1969.

The first improvement was the top-loading air cleaner introduced into production vehicles in 1971, followed by a stabilisation system for the main armament in 1972. The top-loading air cleaner increases engine life by reducing dirt and dust ingestion; the stabilisation system permits firing on the move. Tanks built to this configuration are known as M60A1 (AOS) – Add-on Stabilisation.

In 1974, a model designated the M60A1E3 was tested; this incorporated a number of major improvements including a new T-142 track, laser rangefinder, solid state ballistic computer, Tube-Over-Bar suspension, Reliability Improved Selected Engine (RISE), improved electrical system and passive night sights. These trials were conducted to determine what improvements could most profitably be incorporated into production models to help the M60 series keep pace with other nations' technological advances.

The T-142 track was cleared for production in 1974 and the RISE engine, together with the improved electrical system, in 1975. Passive night sights and a deep water fording kit were added in 1977. Vehicles built to this standard are known as the M60A1 RISE (passive).

Since February 1978, production models have embodied the AN/VVG-2 laser rangefinder, XM21 solid state ballistic computer, M239 smoke grenade launchers and M240 co-axial machine gun and are classified as the M60A3. From November 1978 the gunner's passive periscope has been replaced by a thermal imaging sight. This, with a thermal shroud for the main armament, represents the current production model, the M60A3 (TTS) – Tank Thermal Sight. Numerous unseen refinements have been incorporated into the M60A3; though minor in themselves, these contribute to overall improvement. Some of these include armoured air cleaners, steel return rollers, camouflage base paint, redesigned driver's escape hatch, new crew heater and an uprated turret motor to meet the increased electrical requirements of the stabilisation system.

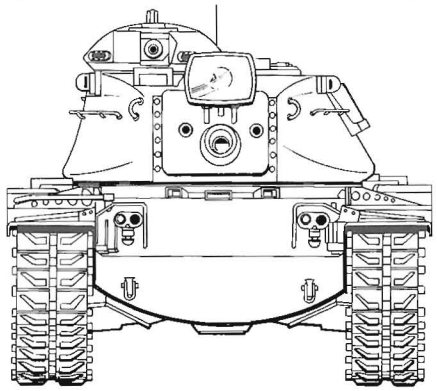
It is envisaged that 2000 M60A3s will be built between 1978 and 1981. The first M60A3s were deployed in Europe in early 1979. Existing M60A1s will be progressively upgraded with these improvements during base overhaul to bring them up to the latest standards. These improvements will greatly increase the M60 series' combat effectiveness; there is no doubt that the M60A3 is at least equal to the latest Soviet production tank, the T72.

The most marked improvement of the M60A3 is in its firepower. The adoption of the new range of 105mm ammunition, including the M735A1 Stabiloy (depleted uranium penetrator) APFSDS round and the improved fire control system, gives a 50% hit probability up to 3000 metres, day or night, effective against even the advanced armour of the T72. The Tank Thermal Sight permits targets to be sensed through smoke, haze, fog, rain or the darkest of nights while the passive night sights, being dependent on ambient light, cannot. The laser rangefinder allows ranging to be accomplished by the gunner, thus freeing the commander to concentrate on commanding the tank.

Other improvements currently under consideration for incorporation into the M60A3 include a low profile commander's cupola (following significant Israeli losses in the Yom Kippur War when the existing cupolas sheared off, decapitating the tank commanders). A fire resistant fluid in the turret hydraulic system with a flash point of 425 °F (as against 210 °F) and a sophisticated Halon fire suppression system that will extinguish fires in the crew and engine compartments instantly are also planned. The relocation of all main gun ammunition rounds below the turret ring is being considered to increase survivability, as is a muzzle reference system to correct for barrel distortion caused by thermal energy. Many additional potential improvements are listed below:

- Improved suspension
- Uprated engine
- Engine smoke generator
- Loader's machine gun
- NBC and Radiac Alarm
- Side skirts protecting the suspension
- Improved brakes and track adjustment
- New final drives
- Navigation compass
- Further improvements to FCS
- Foilage brackets
- New camouflage schemes

These improvements will further enhance the combat effectiveness of the M60A3, and maintain its position in the forefront of contemporary MBTs well into the 1980s and 90s, pending the increased availability of its worthy successor, the M1 'Abrams' Tank.



Israeli M60 Patton tank commander observing fire from a hull-down position.▲

M60A1 on manoeuvres in Sinai.▼

Below: US Army M60A3 participating in the contest. The US team came third out of six nations (after being fourth out of five in 1979 and last in 1977).

One of the first AMX-30 types, no thermal sleeves on the gun undergoing field tests.

AMX·30

The French Main Battle Tank

The disruption of French industry wrought by the German occupation during World War II curtailed development of French tanks in the immediate post-war period. Priority was given to the design of a light tank for employment in the troublespots of France's far-flung colonial empire, resulting in the revolutionary AMX-13 with its oscillating turret and automatic loader. This concept was also applied to the AMX-50 that was to have been the principal battle tank of the French Army, to replace its wartime Shermans. The AMX-50 never entered production – mainly for financial reasons, but also because of waning enthusiasm for such a heavy tank. Instead the French Army received M47 Pattons from the United States under the Military Aid Program.

AMX-30 prototype – note similarity to German Leopard.

French Armoured Corps AMX-30.

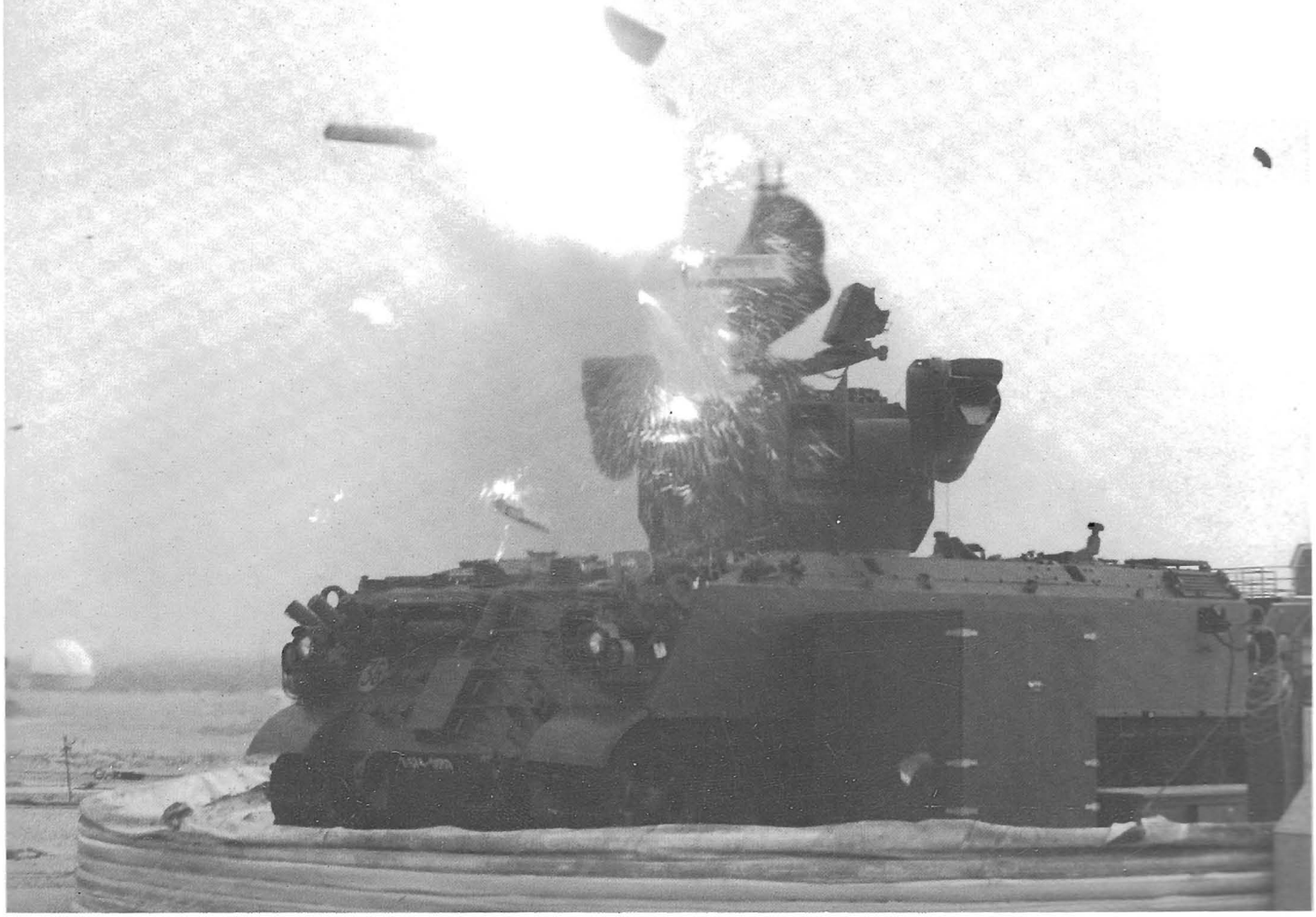
These tanks, however, did not meet the French concept of armoured warfare, which had been influenced by their rapid advance across Northwest Europe in 1944-45 against only limited armoured opposition. The Germans in turn had concluded that greater mobility was needed, following their difficulties in conducting a fighting withdrawal in their heavily armoured tanks, which were prone to mechanical failure. The emergence of hollow-charge weapons of the bazooka type capable of penetrating the thickest armour also tended to discount the worth of heavy tanks.

Thus, both countries reached similar conclusions from their wartime experiences and in 1956 decided on a collaborative effort to design a 30 ton tank of low silhouette with a high power to weight ratio and a 105mm gun firing hollow-charge projectiles. In 1958, Italy joined the programme in a tripartite agreement for a 'European tank' that was to be adopted by each nation following comparative trials of national prototypes.

Design and development of the French version was entrusted to the Atelier de Construction d'Issy-les-Moulineaux (AMX). An early project built around the Maybach 1000 hp engine intended for AMX-50 was abandoned when the weight rose to 40 tons. The SOFAM 12GS 750 hp engine was adopted and the first two prototypes were completed in 1960. Both were armed with the 105mm Vo 1000 gun firing OBUS G projectiles in two turret types, differing in

the fire control system. By this time the German version had diverged somewhat from the original concept, as it incorporated a multi-fuel engine and the British L7 rifled 105mm gun rather than the Rheinmetall 105mm with the OBUS G. After preliminary trials, further prototypes were built, with the French vehicle incorporating the Hispano Suiza 720 hp engine, in keeping with the NATO policy for multi-fuel engines. From September 1963 to October 1964 exhaustive, tripartite trials of IO tanks (5 AMX-30, 5 Standardpanzer) were conducted at Mailly, Satory and Meppen but unfortunately, as with so many collaborative efforts, no agreement was reached. France and Germany decided to adopt their own vehicles, while Italy opted to buy the M60A1.

After further development and troop trials with 501er Régiment de Chars de Combat, production began in 1966 at the Atelier de Construction at Roanne in the Massif Central. The first regiment to replace its ageing M47 Pattons with AMX-30s was the 503 RCC. 1000 AMX-30s have been built for the French Army



ROLAND mounted on AMX-30 chassis on field tests.

Seen from the rear is the engine compartment, above: grinding up a steep slope in difficult terrain; Middle: the AMX-30 Hispano-Suiza HS 110 12 cylinder multi-fuelled engine; Below: 105mm gun traversed left.

and eighteen regular regiments are equipped with the tank (1,2,3,4,5,6,8,11,12 Cuirassiers; 1,2,3,4,5,6, Dragons; 501,503,507 RCC). Each regiment has 54 AMX-30s with four squadrons of 13 tanks and two command tanks. A squadron comprises four three-tank troops and a command tank.

TECHNICAL CHARACTERISTICS

The most interesting feature of the AMX-30 is the CN-105-F1 main armament which combines the accuracy of the rifled gun with the unmatched penetrative power of the hollow-charge principle. Unlike ordinary anti-tank shells, the hollow-charge round is capable of piercing armour irrespective of range as it relies on chemical rather than kinetic energy for penetration. To ensure accuracy at long ranges it is necessary to stabilise the projectile in flight either by fins attached to the round or by spin imparted to it by a rifled gun. However, hollow-charge projectiles lose much of their

armour-piercing performance if spun and, at the time the Modèle F1 105mm gun was conceived, fin stabilisation did not give the required accuracy at longer ranges. The French devised an ingenious solution – the OBUS G. The hollow charge is mounted within a ring of ball bearings whereby the outer casing of the OBUS G spins on leaving the rifled gun so as to retain accuracy while the hollow charge rotates at only a minimal rate with no loss of armour-piercing performance. As a result, the OBUS G is capable of penetrating all conventional steel armoured tanks at ranges up to 3000 metres. A further advantage of the OBUS G is that only one type of anti-tank ammunition is necessary, thus logistic resupply and crew training are greatly simplified. The AMX-30 carries 47 rounds of ammunition – OBUS G, HE and smoke.

Secondary armament comprises either a 12.7mm machine gun or 20mm automatic cannon on later versions. The latter is effective against softskin vehicles and APCs and, since it can be elevated independently of the main armament to a maximum of 40 degrees, provides the AMX-30 with a considerable anti-aircraft and anti-helicopter capability. Such a system is of prime importance on the modern battlefield where the plethora of targets in the form of lightly armoured vehicles may be destroyed without recourse to the main armament, thereby conserving 105mm ammunition for the principal target of any tank – other tanks. In addition, a 7.62mm machine gun is mounted on

Fording a water obstacle – note all hatches waterproofed, driver's compartment elevated for test purposes.

Below: AMX-30 fording water obstacle. Note the waterproofed snorkel casing and elevated gun.

Improved prototype with elevated periscopic sight fitted to commander's hatch.

Training with AMX-30 in central France.

AMX-30S specially adapted for tropical climate: these types can be found in the Saudi Arabian forces, and are also supplied to Iraq, fitted with dust filters and air conditioning.

New improved model, to enter into service with the French Armoured Corps – AMX-30B2 with TV camera (left).

the commander's cupola for close-in defence, which can be fired from inside the turret without exposure of the commander.

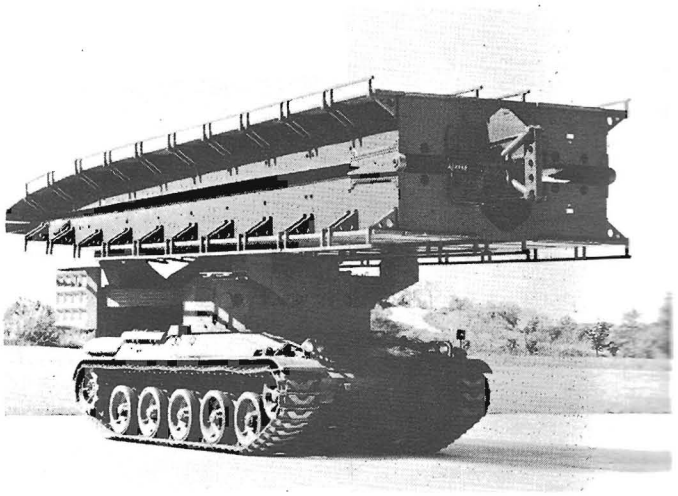
The AMX-30 has numerous observation devices for all crew members. Even the gunner and loader have lateral vision scopes, while the commander has exceptional panoramic vision thanks to the TOP-7 contra-rotating cupola. In common with American practice, the commander conducts fire engagements. Target acquisition is by means of an X10 binocular telescope in the cupola and the commander also operates the 2m base coincidence-type optical rangefinder. Later versions of AMX-30 have a laser rangefinder integral with the commander's binocular telescope so that it is possible to assess range to target without traversing the turret. This is a useful facility when the tank is in a hidden hulldown position because it is not necessary to move the long, revealing gun barrel until the final moment before engagement.

Smoke grenade dischargers are carried at the turret rear to mask the tank behind a thick smokescreen within eight seconds during tactical bounds or from infantry tank-hunter teams. The communications system comprises an intercom for relying orders between the four man crew and two TRVP series radio sets – a TRVP-13 gives communication within the troop and the TRVP-113 within the squadron. Command tanks carry another TRVP-113 for communication with higher formations.

French army exercises: AMX-30 and AS-11 ATGW armed Alouette II helicopter supporting armoured infantry disembarking from their AMX-10P APC.

Tactical nuclear missile launcher type PLUTON mounted on AMX-30 chassis – range 120 km.

Armoured recovery vehicle AMX-30D mounts hydraulically operated dozer blade, main winch and crane.



AMX-30H carrying 22m long class 50 scissors bridge.

One of the outstanding features of the AMX-30 is its mobility. The high power-to-weight ratio of 20 hp/ton gives it excellent performance in all types of terrain and its low ground pressure of 0.77 kg/cm² increases its mobility in mud and bogs. The tank can ford to a depth of 2.2 m without special equipment. At greater depths a snorkel is used to enable it to negotiate rivers to a depth of 4 m. Two types are used: a wide one for training, which allows crewmen to pass through, and a narrow one for combat. Breathing apparatus is provided in case of emergency! On account of its low weight and an overall width of only 3.1 m, the AMX-30 is readily transportable by rail and is within the loading gauge of all European railways, giving it great strategic mobility as well.

At 36 tons, AMX-30 is the lightest of the current generation of Main Battle Tanks. While the advantages of lower weight are obvious in terms of reliability, increased mobility, easier transportation and low silhouette, it can only be achieved at the expense of armour protection. The armour configuration of AMX-30 with its well-sloped plates and lack of 'shot-traps' affords protection over the front and sides from heavy machine gun rounds and on all aspects from small arms fire and artillery splinters. The tank is also protected against the effects of NBC contamination by means of an overpressure system, enabling the crew to operate without having to wear gasmasks. All in all, the protection factor of AMX-30 combines a judicious compromise between its reduced dimensions, low silhouette, the distribution of its armour, its mobility and its outstanding means of observation.

The AMX-30 has enjoyed considerable export success and the tank is in service with the armies of Greece, Iraq, Libya, Peru, Saudi Arabia, Spain and Venezuela. A basic version of AMX-30 is available for export, lacking such refinements as NBC protection, night fighting equipment and with a simplified commander's cupola. Another version, the AMX-30S, has been specially designed for use in desert areas as a 'tropical country' tank. It differs only marginally from the standard model in an adjustment to engine output at 620 hp, slight reduction in gearbox ratios and special equipment such as sandshields.

AMX 30 VARIANTS

As with most current MBTs, AMX-30 has given birth to several derivatives developed to meet particular requirements. The range of variants based on AMX-30 is extensive, and all share the main mechanical components of the MBT such as engine, transmission, tracks and suspension with the advantages that accrue as regards maintenance and support, as well as the training of drivers and mechanics.

AMX-30D Armoured Recovery Vehicle

The AMX-30D is designed to support armoured units equipped with AMX-30 series vehicles by recovering damaged and disabled AFVs in the forward combat zone: by performing earthmoving operations with its dozer blade, and by replacing major assemblies such as engines or gun barrels in forward areas. For this purpose a hydraulic crane is mounted on the hull with a lift capability of 1300 kg through 240 degrees or 1500 kg to the front. The ARV can carry a complete AMX-30 or AMX-10 powerpack on the rear deck as a ready replacement. Protection is similar to the MBT and armament is a 7.62mm machine gun on the TOP-7 cupola for close-in defence. The AMX-30 D entered service in 1975 with the French Army and it has been sold to five other armies.

AMX 155 GCT self-propelled gun

AMX-30 S401A mounting a twin-barrel HS 831A cannon and doppler radar – supplied to Saudi Arabia.

AMX-30HS Pont de Poseur

The AMX30 Bridgelayer carries a 22 m Class 50 scissors-type bridge for spanning obstacles up to 20 m wide. The bridge is launched to the rear of the vehicle within five minutes. Launching is controlled entirely from inside the vehicle by the three-man crew. The AMX-30HS is in service with the Saudi Arabian Army and (in only small numbers) with the French Army, whose principal bridging equipment is the PAA (Pont Automoteur d'Accompagnement).

AMX-30 Pluton Missile System

The chassis of AMX-30 is used as the basis for the launcher system of the Pluton tactical nuclear missile that is only employed by the French Army and is not available for export. The Pluton has a range of 120 km and carries a nuclear warhead of either 15 or 25 kilotons. A new version with greater range and higher yield warhead is under development.

AMX-30 155 GCT Self-Propelled Howitzer

Designed as a replacement of the AMX-13 155mm SPG, the 155 GCT provides indirect fire support to the battle corps by day and night. In keeping with current artillery thinking, the GCT has a high rate of fire (8 rounds per minute), hence the designation Grande Cadence de Tir, and good mobility so that it can deliver a heavy barrage and then move rapidly to a new fire position before it falls victim to counter-battery fire which, in this day and age, is extremely rapid with such weapons as BM21. To obtain such a rate of fire the loading system is fully automatic and 42 complete rounds are carried in the turret. Cross-country performance is comparable to AMX-30 MBT and the armoured turret affords protection against artillery fragments and NBC contamination.

AMX-30R Roland

The Roland weapon system is a Franco/German collaborative design of a low altitude Surface-to-Air (SAM) missile. It comes in two versions: a clear-weather/daylight type known as ROLAND I and an all-weather type, ROLAND II. Both are installed on AFVs – the French version on the AMX-30 chassis and the German on the Marder MICV. The AMX-30 Roland is a completely self-contained weapon system with integral surveillance and tracking radars and with the capability of optical tracking by manual operation. The vehicle carries two missiles ready to be fired and eight further missiles are stowed under armour with an automatic reloading system. The vehicle is employed to accompany armoured formations and to protect them against attacks by low-flying aircraft. The AMX-30R entered service with the French Army in December 1977 and 205 firing units are being procured, 101 of the Roland I type and the remainder Roland II.

AMX-30SA

As a less expensive alternative to an anti-aircraft missile system, the AMX 30SA is designed to fulfil the same role as Roland in protecting mechanised formations from low level attack by aircraft or helicopters. The two Hispano-Suiza 831 A 30mm guns are capable of firing at a rate of fire of 650 rounds per minute against air or ground targets. 300 rounds of ready ammunition are carried with a further 600 rounds in reserve stowed inside the hull. The AMX-30SA is in service with the Saudi Arabian Army.

AMX-30 SHAHINE Low Altitude SAM System

The Shahine has been designed for the Saudi Arabian Army and comprises two elements: an acquisition/control unit and a firing unit which carries a tracking radar and six ground to air missiles. Up to four firing units may be controlled by one acquisition unit which is capable of handling up to 12 targets simulta-

neously. Both units are based on the AMX-30 chassis, with comparable mobility and protection to the MBT. The Shahine fulfils a similar role to Roland.

* * *

In 1979, the French armaments industry unveiled a new version of AMX-30 incorporating many improvements in the field of protection, mobility and firepower with an integrated and stabilised fire control system. Designated AMX-32, it has been specifically designed for export. The most notable feature of AMX-32 is the new fabricated turret of welded plates. It is designed to mount a smooth-bore 120mm gun, but it presently carries the 105mm which, in addition to the full range of conventional shells – including OBUS-G, will fire a new APFSDS round known as 105 OFL. The COTAC automatic integrated fire control system incorporates a stabilised sight for the tank commander, laser rangefinder for the gunner and computerised fire control unit. This system allows the tank to fire on the move with rapid engagement times in the order of 5-8 seconds. Automotive improvements include a new transmission and steering system. The suspension has been strengthened and the upper part of the tracks are protected by armoured skirting plates which can be lifted to give access to the running gear.

Rather than procure the AMX-32, the French Army has elected to upgrade their existing AMX-30s to a comparable standard, to be known as AMX-30B2. These will incorporate the new fire control system and automotive improvements but not the full armour protection. The French Army has ordered a batch of approximately 250 new vehicles to be built at Roanne to AMX-30B2 standard and will retrofit its existing tanks in the near future. At the end of the decade the AMX-30 series will be superseded by the ECP 90 (Engin de Combat Principal) which is being designed in collaboration with Germany. ◆

The writer wishes to express his thanks to Christopher Foss, Mike Roseberg and Pierre Touzin for their assistance with this article.

AMX-32 – a transitional design between the AMX-30 and a new tank under development – which will possibly mount a 120mm smooth bore gun.

One of the Blue Force M60A1 tanks in close up.

An M60A3 of the Red Force is stationed at the entrance to a village, unable to get into firing position due to the minimum damage requirements. His commander says: "I should bust in the nearby barn – but I'd rather stay here."

1

2

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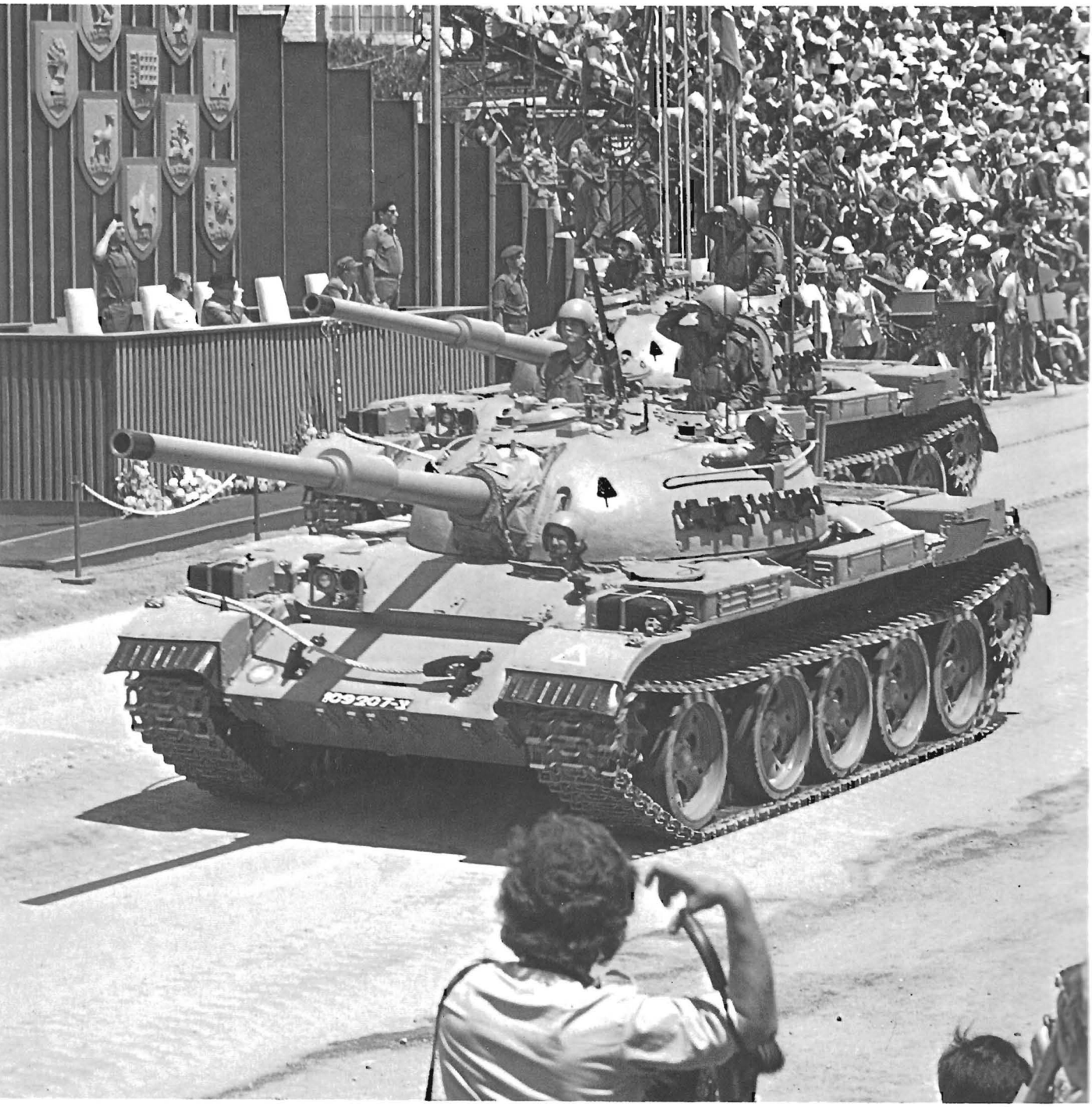
1. *105mm gun ammunition loaded through the side hatch. The gun fires low rotations "G" shell HEAT rounds through a rifled barrel.*
2. *New types of tank-gun ammunition, with elevated commaner's sight fitted.*
3. *Close up view on optical sights and searchlight systems fitted to turret. Note the all-round peritelescope blocks on the commander's turret wing.*

Night firing exercises with AMX-30. Note the large flash of the HEAT round.

Syrian T-62 abandoned near an Israeli outpost on the Golan.

COMPARISON TABLE – MBT (part I)

	M60 A1	*T-62*	*AMX-30*	*Chieftain Mk 5*
Entered service	USA 1961 (M60)	USSR 1964	France 1966	UK 1965 (Mk I)
Crew	4	4	4	4
Combat weight (tons)	48.1	38	36	53.8
Power to weight ratio	13.3	19.7	21	15.5
Length gun forward (m)	9.44	9.40	9.48	10.80
Width (m)	3.63	3.37	3.10	3.50
Height to turret roof	2.89	2.395	2.30	2.55
Ground clearance (m)	.41	.43	.45	.51
Max. speed (road) km/h	48.3	50	64.4	48
Road range (km.)	499	450	600	500
Main armament (cal.)	105 L7A1	115 U-STS	105 Med F1	120 L11A3
Main ammunition type	APDS/1470	HVAPFSDS/1615+	HEAT/1000	APDS/1370
(V^{o} (AP)	HEAT/1170	HEAT/780	HE/700	HESH/670
	HEP/790			
Rounds carried	63	40	50	53
Secondary armament	7.62 Coax	7.62 Coax	12.7 Coax	7.62 Coax
	12.7 AA	12.7 AA	7.62 AA	7.62 AA
Engine type	Continental AVDS 1780-2A diesel	V2-62/V12 diesel	Hispano-Suiza HS 110	Leyland L60 No.4 Mk 7a
HP (max) rpm	650/2400	580/2000	680/2450	810/2250
Cooling	air	water	water	water
Transmission	Allison CD 850-6A	Mech. Synchromesh	5SD-200D	Merrit-Brown TN Mk 3
Suspension	Torsion bar	Torsion bar	Torsion bar	Helical spring
Max. armour front (mm)	110/110/	100/230/	50/20/	150/150/
turret inclination (mm)	60°	70°	80°	60°
Rate of fire rpm	9	7 (2)	8	7



Israel's T·55